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ABSTRACT

Information is a staple of modern society upon which nearly every human being depends. Yet there is a mismatch between the information needs and the information that is available. To assess information needs, a conceptual framework must be built. Information is defined as a symbol or set of symbols which has the potential for meaning. Finding a useful definition of information needs has been elusive, and the continued study of information needs in various contexts, together with the process by which information is communicated, is important. While there are no uniformly acceptable procedures for determining information needs, the methodologies of the social have direct applications. Many studies have been done concerning information needs. There may be conveniently classified in one of the following categories: science, social science, the professions, or the general public. The emphasis of past studies clusters into four groupings: (1) the behavior of the user, (2) the nature, amount and source of information being sought, (3) the quality of the information, and (4) the timeliness of the information. Given the findings of past needs studies, 12 guidelines for the design of information systems are presented. (DC)

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under the
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Part B

Prepared
by

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INTRODUCTION

Information is a staple of modern society. The day-to-day functioning of nearly every human being depends in large measure upon access to and use of information. Without information an individual cannot make adequate decisions nor have access to the resources which are necessary for survival.

A contemporary paradox is that with this basic need for information we live in a time of information abundance. Yet there is a mismatch between the information needed and that which is available. Therefore, it is evident that information by itself is insufficient. Relevant information must be made available at the right time, in an accessible location and in the most appropriate format. Consider this scenario:

Citizen George Abbott is a salesperson in a men's clothing store. But he is also a part-time evening student in business administration at the local community college; a husband of a wife who is pregnant; the father of a 3-year old son; the son of an elderly father who needs to be placed in a home where constant care is provided; and an apartment renter aspiring to homeowner

status now that the family is expanding. He's a church member, a golfer, a Yankee fan and likes to play bridge. And the descriptors go on. Consider the implications for information:

As a salesperson he needs to know about the composition of new fabrics which sells, the latest fashions for men and techniques of determining a person's likes and needs for clothing. As a student he needs information relating to a paper he is writing for class and requirements for entrance into the state college where he would like to earn a B.S. degree. As a husband of a pregnant wife he needs to know how to help her when she goes to the hospital and how to assist with the baby when his wife comes home. He also needs to know about hospital costs and how much his insurance will cover. As a father of a three year old he needs to know what day care facilities are available near his apartment and the nature of the program. Cost will also be a factor in making a decision as to whether or not to send his son to the center. As a son he needs information on nursing homes, Medicare benefits and his father's desire for the best location. As a potential homeowner, he needs to know about the availability of housing in his price range, the availability of mortgage money and the current rate of interest. The reputation of schools in certain areas will affect his decision as will the convenience

to shopping and public transportation. As a church member he wants to know about the religious education program of his church; as a golfer he wants to know how to improve his putting; as a Yankee fan he wants to know today's score and the team's standing in the league; and as a bridge player he wants to learn some of the finer points of the game to improve his playing. And the list goes on.

When we consider the total spectrum of information requirements which George Abbott possesses, we can see that they are of different orders. He has information needs (or requirements) - that information which is absolutely essential for survival and information wants (or desires) - that information which would be nice to have but is not essential for human functioning. He may have a need for information which cannot even be expressed.

Before we go further, it would be helpful to define information, to explore the concept of information needs and to discuss the communication of information.

PART I CONCEPTUAL FRAMEWORK

What is Information?

What is information? It is that which reduces uncertainty. It is that which assists in decision-making. It may exist as data in books, computers, people, files and thousands of other sources. These sources have to be considered simply as raw data until they are used to resolve uncertainties. What we often call information is often a random collection of data which does not become information until it is used by someone to achieve a specific purpose. In the broadest sense, every stimulus offers the potential of providing information but a more manageable way to look at information is to consider it as symbolic representations of reality (words - spoken and written; graphics; pictures; numerals and combinations of all of these). A basic test, however, is its capability to reduce uncertainty.

In the last three decades several disciplines (particularly psychology, communication theory, and information science) have become increasingly concerned with the manner in which humans gather, store, and communicate information. In the past, man survived by successfully applying his senses to collect, store and make use of information about his environment. Now, however, a

technological environment contributes to man's ability to cope with the mass of information which surrounds him. Certain disciplines, each with its own definition of information, attempt to solve this problem by utilizing technology to store, process and transfer vast amounts of information.

Ironically, the information scientist has had great difficulty in defining just what he means by "information". In his study of thirty-nine definitions of information science, Welisch (1972) found only eight definitions of information:

All the rest couched unashamedly in circular definitions, which would be thrown out in an introductory course on logic at the undergraduate level, followed the pattern 'information science investigates information' even the eight valiant definers of information . . . do not . . . arrive at an agreed-upon definition, nor do their definitions have any common element

Another problem in defining the term arises from its usage in both everyday language as well as in scientific parlance. For the former there has been little attempt at analysis. Information can be substantive. According to Webster's Dictionary information may be news, data, fact, intelligence, or knowledge. The public is not concerned that fact, data and news are not necessarily synonymous. All that matters is that "something" has been acquired that one did not have before. Information

theory treats this something as that which is the opposite of uncertainty.

John J. Costello, Jr. (1965, p. 62) sees data as different from information. "Data can be numerically expressed, that is quantified, quantifiable, tabular or objective . . . Data is highly repetitive. Information is not highly repetitive or quantified or quantifiable; it is characterized as narrative, subjective, qualitative, textual or descriptive. Data then, are numbers or unit facts, frequently repeated, whereas information is ideas."

For the moment, we can suggest, like Wellisch (1972), that "any attempt at a scientifically sound statement on the nature (definition) be abandoned or . . . all those who call themselves information scientists must necessarily agree on an operational definition of information." We, therefore, propose a definition for operational purposes: Information is a symbol or a set of symbols which has the potential for meaning.

What are Information Needs?

Words and phrases often interfere with understanding. Such is the case with "information needs". This term has become an umbrella under which a variety of interpretations fall. Because it is a generic term, it often hides more than it reveals. If information needs can be considered a generic concept, then there are subsets which address

information demands (or requirements) and information wants (or desires). There are individuals who can articulate demands and there are those who have a desire for information but are not able to specify what it is that they "need". For example, one person may say that he needs a ride to the office while another person with the same objective may say that he needs a car. The first person has stated a specific requirement and the second has expressed a desire for transportation.

Brittain (1970) helps to chart the semantic jungle. The definition of "information demands" is relatively easy. It refers to the demands, which may be vocal or written, and made to a library or to some other information system. The definition of "information wants" is more difficult. In some cases wants will be synonymous with demands. For example, a user may know that information relevant to his work is available, and makes a demand to an information source. At the other extreme is the individual who makes very few demands but has many needs. This person may have a felt but unexpressed need (perhaps because of inertia or because he does not have sufficient specific details about the need to translate it into a demand) or he may have an unfelt need (in which case he may not be aware of it until this is pointed out, at which time he may readily agree that he has a need). One of the problems of exploring this aspect of user

inquiry is terminological: there is no suitable word for "potential user" or "needer". Parker's and Paisley's (1966) conclusion regarding problems of identifying information needs is useful: "Real needs may go unexpressed if users consider them to be unrealistic (i.e., not capable of being realized by existing systems.)"

Once the distinctions between demands and wants is clear and we narrow our concerns to those information demands and wants which can be expressed, we can consider the contexts in which information needs are expressed.

Taylor (1968) posits four points along the need continuum: 1) an actual but unexpressed need (visceral); 2) a conscious description of the need; 3) a formal statement of the need; and 4) a compromised need. Taylor's analysis of the question-negotiation dialogue between an inquirer and an information broker is bolstered by Rees' (1963) identification of problems which must be resolved in satisfying information needs. While Taylor focusses on the individual involved, Rees emphasizes the interface between the user and the library. Both discussions help to reveal the process of information seeking for the purpose of satisfying needs.

One basic assumption behind the discussions of information needs is that people do need information. Nehnevajsa (1966) begins at this point and further states that "The question is not whether men need information,

for they do. Rather, the issue is whether the information available to them is of the right kind and quantity, of acceptable accuracy, and of appropriate timeliness." The concern for quality is just beginning to be raised in the literature. This concern seems to be central to future considerations of information needs.

In spite of the difficulty inherent in definition, the search for answers continues. Established systems are aware of the need to introduce change or lose their credibility in the community. These same systems know that effective change must respond to needs. Within the past few years public libraries, particularly in the inner cities, have been increasingly concerned with the declining use of their institutions. Charles Bourne (1973) has found that at least 70 percent of the population in the United States never uses a library and that a startling 91 percent of persons over age sixty do not use this free public service. Eighty-five percent of retired persons do not use the library system. As a result, library budgets are declining because society does not feel that the library is meeting the needs of the public. In response to information needs, public libraries are beginning to create programs which will extend services to those sub-groups of the community which have not been adequately served.

Unfortunately, in the past, many systems were established when there was no felt need. Several excellent computerized information retrieval services were established. For example, Syracuse University's Psychological Abstracts Retrieval Service went unused because it did not respond to any felt need on the part of the recipients.

In spite of some failures, systems to satisfy perceived information needs, not necessarily supported by empirical evidence, are still being created. In 1970, the Office of the Mayor of the City of New York perceived a need for "a system to provide the people of the City of New York with access to accurate and up-to-date information on the services and facilities offered by city, state and federal agencies and private non-profit organizations" and accumulated 10,000 items of information regarding such services and facilities. The city has promulgated information on such matters as housing, employment, health services, recreation, civil rights. Utilizing the public library as the channel for dissemination of information, the data bank of the Citizen Information Resource System will be made available and its effectiveness in meeting information needs monitored.

One of the most successful efforts in meeting the information needs of the general public was initiated by the Scenic City and Owen Sound Kiwanis Clubs of Owen Sound, Ontario, which launched a contact center to "put

people in touch with the agencies or organizations best equipped to handle their questions." Expanded quickly through support from Canada's Manpower and Immigration Local Initiatives Program, the Contact Center has grown, flourished, and now provides a model that other cities in North America may want to copy.

It is clear that the continued study of information needs is vital and that information agencies must become aware of the general patterns of information needs that have already been formalized. From the generalizations which can be determined from many studies of information needs, come the guidelines for planning information services. Information agencies can serve both information demands and information wants.

The Communication of Information

Information is a symbol or a set of symbols which has the potential for meaning. With all of the risks and hazards present in that definition, and with some knowledge of the limitations involved, we turn to the relationship between information and communication. Communication may be operationally defined as the transfer of meaning.

In this section we want to give attention to the communication of information, and focus specifically on several contexts and professions (librarians, scientists,

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educators). Both communication and information take on dynamic characteristics of process, and the communication-information interface is established.

But what goes into this interface? How is it composed and what can it do for us? These are not simple questions, and the temptation is to seek any easy solution. But the answers provided by such a quest have failed to take into account the amorphous qualities lending character and brilliance to the many-faceted gem which we know simply as information. In short, information is used daily in a variety of contexts, and, as we use it, we ourselves are shaped by it.

The concern for communication of information is set in context by Meltzer (1971):

Merely spreading data around in various formats through a multiplicity of media does not guarantee the reception and comprehension of information itself. For communication, an exchange of meaning must occur - there must be an understanding of the data.

The communication of information often seems to require the use of intermediaries in information systems. In the case of the library, for instance, the user (librarian) and the consumer (customer) are not necessarily the same person. The librarian becomes an intermediary in the process of information-retrieval. Crum (1969) analyzes the ensuing librarian-customer relationship. He examines the major barriers (physical, psycho-

logical, linguistic, and contextual) in this interactive relationship.

The communication of information occurs also in relationships which are not directly personal. These relationships (e.g., between a receiver and the information itself) present problems often resulting in particular information needs. Lin (1972) focuses on the differences between scientific communication and mass communication, and lists six specific suggestions to bridge the communication gap between science, technology and the public. He recommends:

- 1) that scientists be empathic in their communication with the public
- 2) that an interpretation system be developed to "simplify" scientific information, and that the mass media be employed to disseminate this simplified or interpreted scientific information to the public
- 3) that feedback be established from the public to the scientists
- 4) that the tentative nature of scientific findings be emphasized in scientific communications
- 5) that scientific data be made available in aggregate form to the concerned public
- 6) that scientists refrain from seeking material gains or political authority

Another area reflecting particular consumer information needs is the field of education. Heilprin and Goodman (1965) see an analogy between information retrieval and education based on the limited rates of information

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flow into human sense channels. This problem has been tackled both in libraries and in schools by using reductionist methods such as abstracting and literature reviews. The authors suggest several applications of information storage/retrieval to education in general.

The logical next step is the article by Paisley and Parker (1965, p. 30) in which a case is made for "information retrieval as a receiver-controlled communication system."

We consider the analogy between information retrieval and education to be strongest at the end of the educational continuum at which the largest measure of receiver control is exercised - i.e., the upper end. It is part of our educational tradition to wean a child from dependence on source-controlled communication and to expect of him ever greater self-responsibility in his choice of communication sources, forms, and methods.

Technological advances make possible a multitude of inputs directly into the home as a local information center, but such advances also tend to isolate and further fragment an already bifurcated society. Goldmark (1972) correctly reports that "in many respects the things that (are) done by communications today represent only a fraction of what could be done to improve the quality of life for everyone if communication systems were more carefully planned and if the full potential of certain technologies were exploited."

As a step in the direction of exploiting the full

potential of certain technologies, and using the state of Michigan as an example, Chapin (1971) proposes a public information corporation that would be responsible for the storage, retrieval, and dissemination of public information throughout the state. This corporation would make use of the usual library services but would also utilize computers, public broadcasting, cable systems, and other of the newer information packages. But, as Chapin notes, "we will be able to utilize this resource only as we are able to recognize that the information needs of the citizens are more important than our traditional views as librarians, as broadcasters, as educators, and as entrepreneurs."

These information needs of citizens must take priority over the design and implementation of elaborate, highly sophisticated information delivery systems created to exploit technology. Modern telecommunication systems certainly may extend the use of urban communication but unless these systems explicitly serve to fulfill the actual information needs of people, such technological tinkering will not do much to improve the quality of urban life.

Theoretically, the primary purpose of information systems is to meet various information needs. But many systems (e.g., telecommunication, computer) seem to have lacked utility from the beginning because they ignored

basic information needs in the interest of manipulating the overabundant data already at hand, as though the whole problem were a puzzle which merely required the rearrangement of a set of pieces.

The communication of information is at once simple and complex - simple in the sense that it is reducible to specific, definable, quantitative elements which allow for the breakdown of communication at any point in the process; complex in the sense that these elements must be taken together and studied in a variety of forms and contexts precisely because communication is a process.

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PART II STUDIES OF INFORMATION NEEDS

The Nature of Information Needs Studies

There appears to be a constant struggle to keep abreast of studies of information use. Syntheses of studies appear with some regularity, each covering a given period of time and generally referring to previous syntheses. Most of these tend to be descriptive rather than critical.

Berelson (1949), Menzel (1960), Davis and Bailey (1964), Paisley (1965), Wood (1971), Bates (1971) and Zweizig (1973) surveyed the literature on information use studies in England and the U. S. Since its initial publication in 1967 the Annual Review of Information Science and Technology (ARIST) has included a chapter reviewing, summarizing and criticizing studies on "Information Needs and Uses." Each of these reviews reflects the orientation of the compiler. While the chapters in ARIST are more selective and emphasize the information-seeking behavior of scientists and technologists, other studies have been done primarily by librarians to determine who uses the library and why. These consider the use of catalogs, reference services, circulation and facilities. Another cluster of studies relates to the extent to which information services satisfy specific requirements.

Marcia Bates (1971) evaluates 181 user studies. Her bibliography is divided into two parts: the library and the library user, and the information-gathering behavior of scientists and the general public. She examines the rationale of user studies and recommends several helpful articles on research methodology. Bates provides some critical commentary beyond that which normally appears in an annotated bibliography.

Carter et al. (1967) examines the adequacy of 58 selected studies pertaining primarily to the scientific and technical community. They identify behavioral patterns that have significance for the development of future information systems, such as:

- 1) Principle of least effort
- 2) Resistance to change
- 3) Preference for oral communication

Carter deduces that systems should be easy to use, that change should be evolutionary, not revolutionary, and that these systems should facilitate the dissemination of scientific and technical information through oral communication.

Some Procedures for Determining Information Needs

How can we determine the information needs of an individual if indeed they can be expressed? There appears to be a series of protocols, each of which yields statements of need closer to the "truth" as one moves from

relatively impersonal approaches to more personal probing:

1. Random interview
2. Selected sample interview (mail)
3. Selected sample interview (telephone)
4. Selected sample interview (face-to-face)
5. Diary
6. Observation
7. Participation
8. Therapy

As past studies of user information needs are reviewed, almost every researcher has used the questionnaire and interview techniques of survey research. Since these approaches depend upon a subject's recall of past behavior, the validity of this approach is often questioned on the grounds that a person's recall of past behavior is frequently inaccurate.

A few studies have followed a type of time and motion study requiring each subject to keep a diary and recording his information-seeking activities for some specified period of time. Case studies are sometimes used.

There are unobtrusive ways to gather user needs data, some of which verge on the unethical, e.g., monitoring telephone calls to information sources or counting books checked out of libraries. In these cases, needs are determined inferentially.

A study by Paisley and Mick (1972) attempted to

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develop simple and inexpensive methods for collecting longitudinal data on educator's information needs. Paisley and Mick followed the principle of multiple operationalism. Multiple operationalism holds that each methodology used has a unique set of error factors including test bias, sampling bias and response problems in questionnaire and interview formats. The argument for multiple operationalism is that several data gathering methods can be used in a convergent validation framework that reflects which method best expresses the consensus of all.

Paisley and Mick used:

1. A questionnaire survey in 13 states using local distribution of the instruments and good sampling procedures;
2. A follow-up of educators who wrote Educational Resources Information Center (ERIC) clearinghouses;
3. A survey of educational information specialists;
4. An analysis of queries received by an INWATS "hotline" (an "800" number); and
5. A content analysis of themes in the educational periodical literature.

The information needs of various types of educators were determined by the multiple procedures, but were probably colored by salient needs at the time of response, the limitations of choice on the questionnaire, and perceived access to information which would fulfill the need.

There are no uniformly acceptable procedures for

determining information needs. The National Commission on Libraries and Information Science confirms the many reviews of research in this area. Their current brochure says that "The information needs of users are not well understood. They must be defined and measured before detailed planning can be completed . . . A preliminary study of these needs . . . concludes that the literature on this subject does not adequately specify objectives for the design of future information-supplying systems."

The methodology used to determine information needs is the same as that used in social science research. Such tools and techniques as questionnaires, interviews, diaries, observation, and analysis of existing data, and experiments have the same limitations in user studies as they have in social science research, mainly, that one can only infer from the user's behavior or words what is going on inside his head.

Wood (1971) considers the strengths and limitations of each method used to study information needs, and suggests ways to improve these methods. Although questionnaires and structured interviews are the most useful methods for producing quantifiable data, the standardized form of a questionnaire cannot always reveal a user's unique experience. The questionnaire leaves no way to determine the respondent's mood at the time or to clarify ambiguous questions or answers. The interview, though

more expensive and time consuming, can do these things. A major weakness of questionnaires and interviews is that they cannot collect actual data on behavior as it happens. To overcome this problem, Carter et al. (1967) recommend a structured interview in which the user is asked to concentrate only on a specified time period or project. The resulting data then reflects the user's active behavior rather than his opinion.

While questionnaires and interviews offer quantifiable data that can be compared over several populations and situations, they are not true measures of behavior. Diaries and observation may provide more accurate indices of behavior, though their results often are difficult to quantify. While the diary method should reveal actual behavior, users often refuse to interrupt their work to record their actions.

Through observation the researcher can record the subject's behavior without disturbance. Although this method is better for determining information-gathering habits, very little information about the subject's needs can be gleaned by observation.

Some user studies rely on already existing data, such as recorded reference questions, to determine user needs. These studies obviously are limited, because they reflect only that type of information requested by a formal system, which comprises less than 5 percent of all information sought.

A major problem in the past has been improper or careless use of research techniques. Many researchers in the field of user needs are unacquainted with research methods of the field of social science. Consequently the results of such studies are questionable. Many such studies concentrate on one system to such an extent that their results, though valid for that system, should not be applied generally.

The bulk of studies purporting to examine information needs have in fact evaluated the effectiveness of information delivery systems (libraries). Studies of needs should concentrate on needs rather than on the system supplying the needs. This is not to suggest that studies of systems' effectiveness should be discontinued in favor of information need studies; both kinds of studies are important but should be properly labeled.

The word "information" may mean one fact or a whole collection of documents. As discussed in Part I, the terms "information wants," "information needs," "information demands," and "information requirements" are often interchanged. Existing studies generally have similar defects. Despite the increasing sophistication and number of user studies, "the need of the user is still not well enough known to permit one to completely formulate a design for an information system which will serve him." (Carter, 1967)

A Summary of the Studies

Science. Most scientific information is highly specialized and is recorded in a language that only a few highly trained people can understand. Although everyone uses some scientific information, only fundamental and applied researchers generate new information by experiment, while relying heavily on existing data to produce new material. Since the body of scientific knowledge is enormous, the probability of the essential bit of information getting to the appropriate researcher is low without the help of a well-designed system. Scientific researchers were the first group to feel the effects of the information explosion and to demand better retrieval systems. For this reason, user studies have concentrated on researchers more than on any other group.

Bernal (1950) identifies seven categories of users of scientific information: 1) fundamental scientific researchers; 2) applied scientific researchers and developers (agricultural, engineering and medical); 3) technologists (agricultural and medical practitioners, architects, engineers); 4) teachers, students, report writers; 5) scientific and technical journalists; 6) the interested public; 7) historians of science. A person belongs to one or more of these categories according to his use of scientific information.

The scientist's need for information is obvious but

the kind of information needed seems to vary with every scientist and every research project. For instance, the projects of fundamental scientific researchers are usually subject-oriented, covering several subject areas. The fundamental researcher seeks information within a specific subject area; applied researchers must gather information from several areas in order to solve the problem.

A few studies have tried to determine the subject areas wherein most information needs fall, but the results are applicable only to the population studied, and are not general enough to construct an overview of what subject areas cause the most problems for information seekers. The studies have shown, however, that each researcher has the greatest problem getting information in subjects outside of his own discipline. Since he is not acquainted with the information sources in other subjects, he depends on formal systems to satisfy his information need.

Some studies have divided the total amount of information into two categories -- technical and non-technical. The Department of Defense (DOD) Study (1965) on the information needs of researchers and developers determined that 75 percent of all information sought was technical in nature. There are three types of technical information: data, theories, and procedural information. In the DOD study, data accounted for 41 percent of the total information used. Hanson's survey of user studies

(1964) determined that 20 percent of the demand is for data. Both surveys agree that 25 to 33 percent of the demand is for procedural information; theories represent only 8 percent of the total.

Each of the three types of technical information has a unique mode of transmission. Data is the most easily transferred form of information but it must be current, complete and accurate. Procedures and techniques are communicated best through live demonstration; theories through original papers or informal communication (the main problem being dissemination).

In order to create effective information systems, a number of studies indicate that the following needs must be met:

1. The need for more prompt dissemination of information. Several user studies have determined that the greatest information problem today is the time lag between the production and dissemination of information.
2. The need for quality filtering of information. All information should be screened for accuracy, relevancy, and quality before it enters an information system. This would lessen the effects of the information explosion.
3. The need for the right amount of information at the right time.
4. The need for receiving information in the

desired form, usually oral or written, and in understandable language.

5. The need for active, selective switching of information. The ideal would be to receive the right information without having to ask for it.

6. The need to browse. Perusal of peripheral documents allows scientists to fulfill, through serendipity, needs that they have not yet formulated.

7. The need to get information easily and inexpensively.

8. The need for awareness of current literature, and the need to know of work in progress.

9. The need to know about and how to use available information systems.

10. The need for syntheses of the literature, state-of-the-art reviews, and introductory surveys of subjects.

11. The need to expedite interpersonal communication. If informal communication is considered a kind of information system, many of its characteristics are included in the above list. As a part of this system, each scientist reads documents, stores bits relevant to himself and others, and disseminates these relevant bits rather than transferring the whole document. He also translates the information into terms that his colleagues understand. He saves information and selec-

tively disperses it to those he knows want it. Unpublished and unpublishable information is also transmitted through interpersonal communication (Menzel, 1968). One scientist said that "he had never found that anyone failed to get the information he wanted, provided he knew the right person to ask!" The informal communication system is convenient and easy to use. However, it is only as reliable as the people involved. It is not systematic, cannot possibly be complete in itself, and must be combined with formal systems.

12. The need for a knowledgeable person to guide the scientist to information in fields outside of his own field of study. Scientists have expressed the need for dialogue, which helps the scientist to "personally explain, clarify, and modify his requirements." Only a person more knowledgeable than the inquirer can help clarify the question. Since many of the inquirer's demands for information are in a field different from his own it is especially important for the intermediary to have specialized knowledge.

Although the above requirements are not easily met, they are guidelines for the development of information systems for scientists.

Social Science. When it became obvious that the information needs of scientists and technologists had to be dealt with -- for the satisfaction of their needs was

of utmost importance to society -- librarians, information scientists, analysts attacked the problem with vigor. By 1969 almost 1,000 studies had been undertaken to determine scientists' behavior in gathering information, on the flow of information, on the classification of information, on their need for factographic and documentary information, and on the exchange of information. The fact that these investigations had to deal with physical, natural and applied scientists was no deterrent to the investigators. It seemed that scientists worked alike and in a predictable fashion. What one learned about one group of scientists might be transferred to another. In addition, scientists were extremely outspoken about the need for studies and satisfaction of these needs.

The social scientists, on the other hand, present an entirely different picture. They had not confronted librarians with their needs in the same way as had the physical scientists. Line (1969) noted the overwhelming number of studies of scientists' information needs as contrasted with the few studies of social scientists' needs. In his bibliography, Line listed twenty studies by the American Psychological Association (1963), Appel and Gurr's (1964) study of the bibliographic needs of social and behavioral scientists, and Louis Utterschaut's work. In 1965 Paisley studied the flow of behavioral science information. He concluded that there was no

literature to review and then attempted to extrapolate some needs from the findings of user studies in the physical sciences. He stated that, "We shall infer that information flows to and from the behavioral scientists in much the same way that it flows to and from the physical scientists." Few studies are included in the Annual Review of Information Science and Technology.

In the first volume, Menzel (1966) mentions the American Psychological Association studies but then continues with the natural sciences. In 1969 Allen includes ten reviews in the social sciences and in 1971 Nan Lin reviews a few more. The most intensive study is the work of J. Michael Brittain (1970) Information and Its Users. Chapter III of this book is one of the most inclusive studies of the needs of the social scientists. Brittain discusses empirical studies of "user information needs and requirements . . . in some detail, and brings together certain theoretical writings that have a bearing on nature, organization and use of social science information." Significantly, he states: "User studies like their counterparts in the sciences, have been carried out in the absence of conceptual frameworks although Kochen (1969) maintains that a new discipline is in the making and that user studies will form a part of this discipline; so it is possible that the state of this theoretical poverty will not continue." (p. 34)

Maurice Line, assisted by Brittain, can be considered the forerunner in studying the needs of social scientists. In 1967, Line organized a study using a methodology different from that used to determine the needs of the physical scientists. Line found that social scientists were extremely print-oriented, preferred English language materials, wanted statistical, methodological and conceptual information rather than historical and descriptive, and preferred to perform their own literature searches. The questionnaire also indicated that needs varied among social science practitioners. For instance, teachers and social workers differed in their awareness of an information problem and in their admission of a need to be filled. "Social workers had . . . a sort of information conscience; teachers, on the other hand, where they were not plain apathetic, showed some suspicion, even hostility toward educational research; they saw the need to keep up with the subjects they taught, not with educational theory, research and practice."

In the nineteenth century, the political science emphasis in methodology was primarily on theory, philosophy and description, presuming a need for books, periodicals and essay-type literature. The twentieth century researcher in the political science field requires a different type of information -- factual, statistical and numerical. This situation creates the need for

social data banks. Changes in research methodology have also taken place in anthropology.

Robinson (1970) and Lowi (1972) represent approaches to information needs inferred by studying the nature of social science research. Political scientists, for instance, need information to cope with the impact which the information technology is having on the citizen, his participation in decision-making, his social movements, and his personal privacy.

The increased numbers of information-gathering agencies serving the executive branch of government is one of the reasons attributed to change from congressional dominance to executive leadership. With additional information, the executive has advocated its point of view in the news and editorial media, and with party organizations in the states. Congress and the Executive have switched traditional roles about initiating legislation due to the fact that the Executive has been identifying problems, thereby dominating Congress' agenda.

Janda (1968) identified a number of studies which have indicated that the information problem is the major factor in the decline of modern legislatures. He cites the Griffith, Woll, Keefe and Ogul report which identifies Congress' deferment to the Executive for answers and recommendations. "Regardless of how much Congress has attempted to inform itself . . . its store of information

and its access to necessary knowledge are rarely if ever as developed as that of the executive authority."

In 1963 Dartmouth's Public Affairs Center took a random sample of eighty representatives. Each respondent was asked to "name any problems which prevented him from carrying out the role he would like to play in the House and all problems which he saw as preventing the House from operating as he thought it should." The greatest problem, the respondents suggested, was "complexity of decision-making; lack of information." (Janda, p. 311)

We turn to studies of needs in other disciplines in the social sciences. We have observed that few studies have been undertaken in economics, anthropology and sociology. Far more attention has been given to information needs in the field of political science, applied economics, business and industry, psychology and education. The field of anthropology is so interdisciplinary in nature that some of the needs of the anthropologists can be assumed from the studies done in the natural sciences. Amsden (1968) studied the need for a new type of gatekeeper as well as information exchange. She emphasizes the anthropologists' need for person-to-person contact.

Obviously, a considerable amount of study is still needed in the social sciences. A workable methodology is needed to study the needs of social scientists which differs from that used to study information needs in

other fields. Brittain (1970) points out that the pattern of future information needs studies should be tempered by factors internal to the social sciences; general attitudes to the organization and support of research; and technical aspects of information transfer including mechanization. (p. 156)

The Professions. The literature regarding information needs of educators, clergymen, lawyers, doctors, social workers and other professionals is scanty. There have been studies on each of these populations as well as on businessmen, publishers and clinical psychologists. Unfortunately, the studies are too limited in number and scope to draw inferences regarding the information needs of professionals in general or even about specific professions. It is a temptation to infer information needs of professionals from those of the basic disciplines in which they were prepared, e.g., a doctor's information needs might be closely related to those of a scientist and a social worker's information needs might be like those of the social scientist. This should not be done. The information needs determined for scientists and social scientists are more for the academic and research-oriented individuals and not for the applied workers. One exception is engineering.

The scientists' main goal seems to be to generate and publish new information, while the engineer's goal

is to develop and improve a product or process. Publication is a secondary concern for the engineer; instead, new information may be kept in-house or it may be patented and sold. Unfortunately, much information of value to other engineers never appears in the professional literature, and when it does it may be in such specialized language that they cannot understand it. The engineer often wants information that exists in another organization's documents, but is unpublished and is not distributed by the other organization. Scientific literature is generally of little use to the engineer since natural scientists write primarily for other scientists. The scientific and technological research fronts are concerned about different subjects; very few common interests exist between the two (Marquis and Allen, 1966).

Most engineers work in mission-oriented government or private industry. For reasons of security or profit, communication between these organizations is limited. Communication between organizations is also made difficult by the communication systems peculiar to each company. Few invisible colleges exist in engineering as they do in science. Internal reports and co-workers in the engineer's own organization are his most available sources of knowledge.

Just as there are differences in needs between

engineers and scientists, there is considerable variation in needs among most engineers. Needs vary according to occupation and specialty. Rosenbloom and Wolek (1970) classed engineers by their occupational specialty and then identified sources that each specialty uses to find information. Engineers rely more on information sources within their corporations than do scientists. Research engineers who generally develop products which are contributions to the broad technological community depend on outside sources for information. Engineers in development, design, testing and analysis, whose work is of interest mainly to their own company and not to the field as a whole, rely more on inner organizational sources for information.

Gerstberger and Allen (1968) surveyed research and development engineers to determine what criteria they use to select information sources. Four criteria were studied: 1) accessibility, 2) ease of use, 3) the quality of information, and 4) the familiarity with the source. They found that accessibility was the primary reason for using a source.

In previous units, we have noted that people are often unaware of the information they need until after they receive it. Engineers are no exception to this rule. In Rosenbloom's and Wolek's study, both engineers and scientists reported that they were unaware of needing

one-sixth of the information they received, until after they received it. Rosenbloom and Wolek (1970) conclude: "It is clear that information transfer is not just a problem of information retrieval. In the transfer of technical information in industrial laboratories, information looking for the man seems to be nearly as frequent an occurrence as the man seeking information." (p. 19)

The engineer's main information problems can best be solved by: 1) facilitating information flow between organizations; 2) making the channels likely to yield the highest quality information through the most accessible channel; 3) translating scientific and technological advances into terms that engineers in other specialties can understand; and 4) directing the right information to the right man before he asks for it.

The one generalization that stems from the existing studies of professionals is that information needs are job-related and tend to focus on techniques or procedures for improving existing practice. The need to know what others are doing and how well new methods work seem to dominate the information needs of all professionals. There does not appear to be a need for substantive information about the field itself nor even new research findings. The format appears to be important. It should be brief, highly readable, and specific.

The General Public. The general public is everyone -- including the scientists, social scientists and professionals we have just discussed. Everyone needs information. The problem is that information needs do not exist as universal and objective entities; they are formed by individual characteristics and environmental circumstances. And, because a great many people have difficulty conceptualizing their information needs, much less articulating them, such needs must be inferred. What is needed is a method whereby inchoate needs can be manifested in terms of specific information requirements -- a formal statement of the need.

Such a method does not yet exist, but an examination of the concept of information does suggest an approach that will at least isolate the problem and render it more manageable. Colin Cherry (1961, p. 168) states that "Information can be received only where there is doubt, and doubt implies the existence of alternatives -- where choice, selection, or discrimination is called for." Information reduces uncertainty in making selections. But (to compound the complexity) the process of decision-making is very frequently an unconscious one, and the acquisition of information is often accomplished without overt action on the part of the recipient. Such information is unconsciously organized and stored for present or future use.

Thus, there are two kinds of information needs. In one case, the need is shaped by an activity, such as decision-making or problem-solving; in the other, the need is latent and is manifest through a passive reception of information which is stored as knowledge. As knowledge increases, whether actively or passively, it tends to generate specific additional information needs. The two kinds of needs, therefore, are neither static nor compartmentalized; they blend with each other and they vary with passage of time. Information, as we have said, is a symbol of a set of symbols which has the potential for meaning. All these generalizations, though they obviously do not constitute a methodology for articulating information needs, do provide an approach.

Who has need for information? What kinds of information do they need? Taylor has indicated that the general concept of information needs can be studied -- only -- in relation to particular, identifiable groups or publics. These may be specified according to age, education, income, profession, and other demographic characteristics. Studies of particular groups, though, generally deal more with information-seeking behavior than with actual information needs. Research on ghetto residents and the urban poor has stressed information-seeking behavior and information dissemination. One study (Bourne, et al., 1973) did identify "clearly

defined population groups with special needs" but reported the obvious results in most general terms. With visible concern for minority groups, this study attempted to identify the information needs of various sub-groups of the population that had information needs "significantly different from the needs of the national population in general." Among the sub-groups were: older people, young children, reservation Indians, rural populations, college and vocational training students, migrant workers, illiterates, the mentally retarded, prison inmates, and physically handicapped persons. Identification of the needs of such sub-groups of our population, with a view toward providing more effective services for these people, is without question a most important task. This particular study, however, reported only such general needs as better physical access, special forms of materials, and special content of collections.

A survey (Rieger and Anderson, 1965) of the adult population of five counties in Michigan's Upper Peninsula yielded data on information sources and needs. The sample identified financial matters, occupational, professional, and farming matters, public affairs, consumer information, and educational and career planning as "topics of major importance in everyday life on which it was 'particularly difficult to find useful and reliable information,'" ; sources of information presently in use

concerning the topics mentioned were also specified.

Current consideration of the concept of "information needs" may be partly responsible for the significant shift in the fundamental direction of services some libraries are seeking to provide. The move is from a "warehouse" or repository of "knowledge" based on elitist principles to a model based more on people and activities, as exemplified by the Neighborhood Information Center. The idea of a public library serving as a neighborhood information center is not new, though novel methods are being tested to overcome the anti-institutional bias many people hold toward libraries. Also, libraries are trying to take seriously the needs of various population groups through research into the communities they hope to serve.

In Cleveland, for example, two neighborhoods were chosen for surveys "conducted to elicit specific community needs and indicate priorities in each neighborhood selected." (Turick, 1973, p. 2) The ninety questionnaires completed in the Woodland area, a primarily black neighborhood, were felt to be representative of a majority of the residents of that community. This survey revealed that:

- information needs of residents are only fairly well met
- information resources of the community are not fully used
- the five most important needs of Woodland residents were:

- 1) housing
- 2) employment
- 3) city services
- 4) health care services
- 5) food and food stamps

The survey also revealed that 77 of 90 persons thought their own branch library would be a convenient information center.

In Houston, Texas, two areas presently served by branch libraries were selected as target areas for a needs assessment survey. "In the preliminary draft of the survey it was reported that residents in the Carnegie area perceive libraries to be places in which you find out what to do and where to go if you have a problem, a 64 percent greater awareness than that of the residents in the Kashmere Gardens area. Residents of both areas seemed receptive to the idea of the Neighborhood Information Center." (Mier, 1972) The Houston study goes on to report the "problem needs" of each area as follows:

A. Information Needs of the Carnegie Residents:

1. Medical and health services
2. Money matters and taxes
3. Services provided by the city
4. Legal help
5. Information about child care

B. Information Needs of Kashmere Gardens Residents

1. Services provided by the city
2. Medical and health services
3. Legal help
4. Money matters and taxes
5. Information about child care

The Houston report illustrates the re-thinking going on as

library personnel give more thoughtful attention to the needs people have for information.

One problem facing those who would do research on needs is the tendency to blur the distinctions between wants and demands. According to Rogers and Shoemaker, "a need is a state of dissatisfaction or frustration that occurs when one's desires outweigh one's actualities, when 'wants' outrun 'gets'." (Rogers and Shoemaker, 1971; 105) Social psychology, accordingly, carefully notes the methods and problems in the measurements of wants.

Can people think in terms of having information needs? If so, can they voice these needs as actual "needs for information" or must they be couched in some other form? How safe are we in providing services based on inferences drawn from some expression -- however "inadequate" -- of an "information need"?

The measurement of information needs of the general public poses problems so great that many of the studies purporting to examine information needs actually report information-seeking behavior. According to Brenda Dervin, "the everyday information needs of U. S. citizens are numerous and diverse. The nature of these needs varies radically from community to community, population subgroup to subgroup, month to month. While there is not a great deal of evidence available, the little available work suggest the immensity of the information need problem. (Dervin, 1972)

A study to determine "the nature of everyday information needs expressed by general-population adults" compared the information needs expressed by residents of Syracuse, New York and Seattle, Washington. In the former location, 460 adults were asked to think of instances in which they needed information about something and had found it difficult getting answers. In this survey, the respondents were not asked if they had a specific type of problem; yet 185 (40%) of the sample generated 160 different specific problems, most of which clustered around consumer shopping information and medical and health information. In the Seattle study, 316 adults were randomly sampled from listings in the phone book. These respondents named 1,471 needs in response to 15 question probes, for an average of four problem statements per respondent.

The idea of information in relation to problems to be solved may be the most useful approach when we set about measuring information needs. The study of the use of information in everyday problem-solving in Seattle and Syracuse employs a scheme developed by Westat Research, Inc., for its information needs study of the citizens of Baltimore (Westat, 1972).

Dervin's (1973) paper on "The Information Needs of Urban Residents: A Conceptual Context," based on data from the Baltimore study, offers a conceptual model of

the individual and his information needs. Among the salient points Dervin makes are these:

- The average U. S. urban citizen is suffering from a large and ever-growing information crisis; citizens are frustrated in their attempts or unable to get information for everyday problem solving.
- Not one single systematic study with a well-sampled population was found which documents the nature of information needs or shows which type of people have which needs.
- The different perceptual bases of needs (citizens have) may well act as barriers to information accessibility. An individual may not be aware of his information needs or he may not be able to verbalize them.
- The entire definition and scope of a burgeoning information agency depends, in part, on how people perceive needs. If individuals do not separate information from help or service, then the entire basis for 'information' counseling is challenged.
- No empirical evidence has yet been generated which would help clarify the issue of information advocacy service in the U. S. A few guidelines are available from tangential evidence which suggests that the way people express their information needs may inexorably lead the information counselor into the problems of advocacy and resource delivery.

Most of the information professionals who have seriously considered the matter of information needs agree that very little is known about the information needs of the general public and that such knowledge is a prerequisite to designing improved delivery systems which serve the average citizen.

PART III SOME GENERALIZATIONS ABOUT INFORMATION NEEDS

Generalizations about user information needs can be gleaned from the studies which have been completed even though the quality is uneven. The statements which follow are indicators of user's information needs, not laws based on empirical research. Many of the generalizations need to be tested further; others provide guidance for planning information delivery systems which will meet user needs. The principle here is that some evidence, however meager, is better than none at all. But caution is advised in gross acceptance of all findings. Each generalization needs to be interpreted in light of the audience being considered, the circumstances in which information will be used, the purpose for which information is sought, and the manner of delivery.

The generalizations include studies of many populations--scientists, social scientists, professionals and the general public. While there is some danger in mixing all the populations, it is probably more useful than to indicate separate populations at the present time.

The existing studies on user information needs seem

to cluster around four major groupings, regardless of the population being studied: (1) the behavior of the user; (2) the nature, amount and source of the information being sought; (3) the quality of information; and (4) the timeliness of the information. We shall explore each group of findings.

THE BEHAVIOR OF THE USER

1. People tend to seek out information which is most accessible.

The search for information is not necessarily undertaken with the idea of maximum return, but according to the philosophy of least effort. This principle of "least effort" (Carter, 1962) can be observed in almost any facet of life; it is not limited to information-seeking. Dervin (1972, 1973) emphasizes that the lack of accessibility is a major frustration in the citizen's attempt to get information for everyday problem solving.

2. People tend to follow habitual patterns when seeking information.

Since most people are not active information seekers, (Dervin, 1973) individuals will seek out search strategies, institutions and systems which have been used successfully in the past. Paisley and Parker (1966)

noted in their study of information retrieval that habits of information seeking, built up over a period of years, influenced the user's patterns of retrieving and seeking information. Television and radio, habitually used by the public, provide a natural communication link between information and the user. Both media are such automatic and unobtrusive means of supplying information, the seeker may not be aware of the extent of its effect. Goldmark (1972) suggests that these communication devices can provide the entire community with health, education, law enforcement, welfare, transportation and other necessary information.

See also Carter (1967), Hilgard (1956), Menzel (1958), Hull (1952) and Wuest (1965).

3. Users and potential users of information are often unaware of sources and how to use them.

This generalization depends, of course, upon the type of user. The sophisticated as well as unsophisticated user is frequently unaware of sources. Information needs can be stimulated simply by the knowledge of what facilities, services and materials are available. Mendelsohn (1968) found that 60 percent of his low income respondents had no idea of where

to go to get information for problem solving. Rieger and Anderson (1968) found that many of their general population adults expressed frustration in finding information on such everyday problems as financial, consumer and occupational planning. Bernal (1957, 1959) noted that "scientists are usually untrained in any matters concerned with the storage and collection of information and do not even know what services are available. He also stated that the user may well know what he wants from an information service, but that he is in no position to know what he needs from it . . . " Hearle (1963) found that planners were frustrated in their attempts to obtain information because of the scattering of information and data banks.

4. Face-to-face communication is a primary source of information.

Studies of professionals and researchers indicate that they often contact other professionals and researchers they know have the information required at the moment. The same pattern is reflected in the general public. Studies show that individuals ask friends, relative or neighbors for information that is needed immediately. In matters of social services, there is often a person in a neighborhood

who is considered to be the major source of such information. Rogers (1968) perceived that:

While formal lines of communication in an organization are more visible, we should never forget that it is through word of mouth networks that much diffusion occurs Some research on industrial settings suggests, in fact, that the formal channels often only serve to confirm news already disseminated through informal channels. However, while the grapevine offers opportunity for rapid diffusion, it is also subject to considerable distortion of the message, particularly when the information is complex.

Wood (1971) cites innumerable studies confirming the use of informal communication as a convenient source of information. Scientists interviewed in the DOD study of research information flow stated that their colleagues offered the right amount of information within the time required. Scientists prefer to use informal communication channels because information frequently passes through this network at least two years before it appears in print (Menzel, 1964). Crane (1968) observed that colleges are held together by highly influential scientists who have, over the years, accumulated a large group of former research students. Business executives use more oral communication than other groups (Keegan, 1964). Bernal found that technologists use more oral communication than research workers. Further discussion of the literature on this generalization can be found in Allen (1968), Price (1963), Rosenberg (1967) and Rosenbloom and Wolek (1966) and others.

5. Different types of persons use different sources of information.

The ranking of information needs is dependent upon such individual differences as age, race, level of education, geography, occupation, financial situation, hierarchical status in the community or organization with which they are affiliated. Hanson (1964) noted that differences in the patterns of demand are frequently associated with disciplines and employer groups. The simpler the language, the larger the audience. Funkhouser and Maccoby (1971) confirm this hypothesis in their study of the problem of communication of information to a lay audience using a reverse approach to the use of sources of information. They reported on "the results of an empirical, quasi-experimental study on textual variables in science writing and their effects on a lay audience."

THE NATURE, AMOUNT AND SOURCE OF INFORMATION BEING SOUGHT

6. The nature and content of information needed is variable and complex, varying from discipline to discipline and from group to group.

Taylor (1968) emphasized that the negotiators of information should be alert to the personal characteristics of the inquirer since this influences the nature

and amount of information needed. Line's (1971) interviews revealed marked differences between the needs of researchers and teachers. Education lecturers and school teachers needed information less urgently than other social scientists. While many social scientists are engaged in both research and teaching, priorities are usually assigned between the two. Bernal (1960) pointed out variations in the needs of seven sub-groups of scientists; Brittain (1970) and Line (1971) those of the social scientists. Unfortunately, most studies have concentrated on the channels of information such as preferences, abstracts, indexes and catalogs used by information seekers and the problems associated with these, rather than studying the content of the material required. Determination of substance is an extremely difficult problem.

7. There is a wide range of need among users in the quantity of information required.

Sometimes broad, general information is required. At other times, specific information is most helpful. At still other times, the individual is attempting to assimilate the information and needs feedback in order to have a means of evaluating understandings, ideas, expectations, progress and his own self-concepts.

Menzel (1964), Bernal (1960, Wood (1971), Dunn (1966), Paisley (1966), Anderson (1968) and Dervin (1973) emphasize the need for delivery of the right amount of information in an acceptable time-frame. Success in interpreting this need is the key to user satisfaction.

8. The quantity of information often exceeds the capability of the individual to use it.

In many situations there is an overabundance of literature. This is called "information overload."

For instance, Congressmen have quite enough information "in the form of bills, reports, speeches, testimony, regulations, decisions" Furthermore:

[they are] swamped with documents produced by Congress itself, and they are deluged with publications of executive agencies. On one hand, not all of this information is needed by Congress, while on the other hand Congress still needs much information which it does not get Congress' problem is one of obtaining relevant information. What Congress really requires is a procedure for acquiring the information it needs and a method for processing that information in order to learn what it wants to know. (Janda, 1968)

On the other side of the coin, Weick and Klare, in a chapter in People and Information, find that despite the growth of available information, which at first glance suggests overload rather than insight, individuals, in their everyday doing of science, develop practicable (and for them functional) rules for searching and selecting the relevant and avoiding the peripheral. How many of our

protestations have been gloss rather than reflection of actuality? (Pepinsky, 1970)

9. The information needs of the individual change at different stages of his career and with changes in his projects.

"It is, perhaps, self-evident that information needs will vary not only according to the subject interest of the users, but likewise in relation to the type of activity in which they are engaged." Rees' observation (1963) can be extended even further. Information is gained throughout life. It is often perceived by one individual differently than it is by another. This is what makes information so elusive and the determination of information needs so uncertain. The information needs of the individual change as the various aspects of a task or problem are completed. New needs appear as former needs fade. There are probably very few needs which recur regularly which individuals do not form a strategy for meeting. The changes of information needs over time differ in substance as well as in source. Menzel (1964) and Voight (1958) correlate changes in information needs with type of project.

10. Information gaps exist because of the inability to locate information in formal or informal sources.

It is likely that needed information is available, but its location is unknown. This fact often leads to duplication of effort. Hearle (1963) found that the same type of information was frequently scattered throughout a number of governmental agencies without any key to its location. Boggs (1966) found that the information sought by anthropologists was frequently available in private files inaccessible to other anthropologists. Menzel (1964) and others note that valuable papers delivered at conferences never appear in the literature, but remain hidden as unpublished manuscripts. In some professions it has been said that it is less expensive to reinvent a product or procedure than to do an adequate literature search for the information required to reproduce a product or procedure.

THE QUALITY OF INFORMATION

11. Users of information services are often dissatisfied with the quality of services available to them and the assistance they receive in using these services.

The dissatisfaction stems from such matters as the adequacy of the collection or data bank to provide the specific information required; the unwillingness of information personnel to assist in location appropriate information; and the time it takes to get the information. The President's Science Advisory Com-

mittee (1963) urged that libraries and information systems provide competent personnel, quality programs and the development of regional and national networks of knowledge. See also the Auerbach Corporation (1964), Material Advisory Board (1964), U.S. Atomic Energy Commission (1964) and Carter (1967).

12. An inverse relationship frequently exists between the quantity of information and its quality.

We often try to provide more information with the notion that needs will somehow be met. School libraries have added a variety of nonbook media to all the printed materials in an attempt to saturate the learner with a wide spectrum of resources which, hopefully, satisfy learning needs. A request for information often leads to a long bibliography which may be appropriate but impractical to search.

The quantity of information available in many fields is exceeding the capacity of the individual to evaluate its usefulness. There is an expressed need for better rather than more information. With the vast amounts of information available, there is a wide range among users in the quantity needed or consumed. This variability is related to motivations, capacity, the nature of tasks and other factors.

Quantity of information alone will not, in most cases, bring about consensus nor help to make decisions. However, insufficient information can lead to hostility. There are groups of parents and citizens who are seeking information about their schools--pupil data, teacher evaluations, costs, productivity and the like. When such information is "managed" or entirely withheld, dissension occurs. Sufficiency does not seem to be the single critical factor in acceptance of information to meet needs but insufficiency can lead to alienation of publics from whom consensus is being sought. (Ely, 1973)

- 13 . Information for routine, day-to-day, decisions is abysmally low, and the information systems which have been made available to help people answer such questions are grossly inadequate.

The findings of Dervin (1973), Dervin and Zweizig (1973) and Olsen (1973) have revealed that the availability of the information needed by the general public for day-to-day decision making is abysmally low based on studies of urban residents in Baltimore, Seattle and Syracuse. Similar surveys of the general public, undertaken by Turick (1973), Mier (1972) and others in Houston, Detroit, Atlanta and Queens, preparatory to the establishment of urban information centers, also disclosed that the

information needs of residents are only fairly well met. The citizen generally did not know where to locate information relating to housing, employment, health care and other service needs. This supposition is probably not as applicable to the needs of the more sophisticated researcher.

TIMELINESS OF THE INFORMATION

14. When information is needed, it must be timely, accessible and relevant.

The literature is replete with studies emphasizing these three elements of information need. The articulation of information science programs is based on the thesis that there is a need for access to recorded knowledge that must be satisfied by providing rapidly, conveniently, economically and with precision, that portion of the current or previous literature that will be useful--

- to a particular individual
- at a particular time
- for a particular problem or interest
- and in a form that is useful to him
- regardless of:
 - where it was generated
 - in what form or language
 - and in a form that is useful to him.

The utopian dream is to have information available on the day of publication, neatly packaged in quanta which are of infinitely variable size and content.

Timeliness is a need expressed by many of the segments of society whose information needs have been studied; for instance, businessmen, scientists, anthropologists, political scientists. Timeliness not only characterizes the age of the literature which is needed, but the length of time needed to retrieve information. The effects of delay may be measurable in dollars and cents. Paisley cautioned:

System speed, for instance, will not count for much if information is old to the point of obsolescence before it is deposited in the system. In many fields, information has only archival value by the time it reaches print in primary journals.

See also Amsden (1968); Carter (1962); Menzel (1964).

PART IV GUIDELINES FOR THE
DESIGNERS OF INFORMATION SYSTEMS

Although the focus of our attention has been on information and information needs, obviously this topic was not investigated for its own sake. Our society is confronted with a number of information needs and problems and we do not seem to have adequate institutions or mechanisms to solve them. Rees (1963), Pings (1965) and Bourne (1973) review the traditional libraries' inability to satisfy these needs and note that many specialized information bases have fallen by the wayside. Perhaps the problem has been the failure of our information systems to respond to the needs of the user.

Alan Rees' observation (1963) that the information retrieval field has been plagued for many years by busy people spending large sums of money, designing--or attempting to design--phantom systems for non-existent people in hypothetical situations with unknown needs has become classic.

In the past three decades, since the exasperated information seekers have expressed their needs for more information, and since a more sophisticated technology is at hand to satisfy these needs, the information scientist has recognized his responsibility to merge the two. Maurice Line (1971)

for instance, designed protocols to investigate information needs with the thought in mind that the results would enable the information scientist to develop systems best suited to the needs of that portion of the population being studied. Information researchers concentrated on studying the needs of the research community. Bernal (1960), Menzel (1967) studied the needs of the scientists; Auerbach Corporation (1964) engineers; Line (1971) and Brittain (1970) social scientists; Boggs (1966) anthropology; and Hearle (1963) city planners. By the late sixties, the focus of attention began to shift to the information needs of the average citizen, those persons not associated with any discipline or a research environment, but who were coping with neighborhood and local problems demanding solutions. Dervin (1970-73), Bourne (1973) and Olsen (1973).

All of these investigations produced results. The user was identified; his needs were characterized. Regardless of discipline, occupation, or level of education of the user, certain patterns of needs common to all began to appear. These patterns had implications for the improvement of and development of new information systems. They offered clues as to what should be included in a system or more significantly, what should not be included in a system.

The following guidelines, which emerged from these studies, might provide some basis for consideration and development of a user-oriented information system or what

Paisley and Parker (1963) have defined as a "receiver controlled information system."

GUIDELINE I. Identify the specific information the user actually needs or requires for what he is doing.

This first guideline appears to belabor the obvious; but it is the obvious that has been overlooked. Line (1971), Taylor (1968), Rogers (1968) and others allude to this premise as the first requirement in designing a system. Almendinger (1966) states that the answer to this question determines the characteristics of the system and the basis for the design which precedes implementation. Brittain (1970) observed that:

the advent of the computer-based information storage and retrieval system, the application of systems theory to the management and planning of information centers and libraries, and the sheer cost (and perhaps novelty) of these systems have played a part in drawing attention to the design (including user-requirements) of systems. These systems involve feedback from users that could not be incorporated in a non-computer based system. There is, in short, a movement toward a receiver controlled system and movement away from a source controlled system. The attention to user-oriented information systems is only one example of a growing phenomenon. Attention to, and demand for, user oriented services is currently to be seen in a wide range of human activities.

GUIDELINE II. Identify the user in relation to his discipline or environment.

It is not enough for the systems designer to know that an individual fits into a broad category--such as scientist, social scientist, humanist--but he must identify

the sub-groups within each category, since each one requires a different type of information to satisfy his needs. Bernal (1958) identified seven sub-groups of scientists, each sub-group with its own idiosyncratic needs.

For instance, the sub-group composed of applied scientific researchers and developers was far more numerous than any other group of scientists and needed more information; technologists needed less, but the information needed was not easily available; teachers, students and report writers needed thorough coverage of a particular field, thus "subjecting information systems to serious and probably salutary strain." Historians of science do not have an information problem because retrieval of information is part of their professional skill and far more information is available to them than they need or want.

Such sub-groups are peculiar not only to the scientific community, but have been noted in other disciplines. Dunn (1966) noted the sub-groups existing in the field of the economist; Bourne (1973) and Dervin (1970, 1973) the general population; Robinson (1970) political science; and Brittain (1970) social science.

GUIDELINE III. There must be interaction between the information broker and the user whether he is a part of the research community or the general public.

The interdependence of the user and the information

broker cannot be stressed enough. Edgar Dunn (1966) perceived that one of the problems in designing a useful system for the economist was the fact that the user and producer of numerical files relevant to social science reserach have in the past lived in worlds that were largely independent--each ignored the other and there was little feedback between the user requirement and the system that generated the data. For better or worse, the producers and users of quantitative social science information systems are closely related to each other and the principal constraint in carrying out research appears to be in the limitation of the research input.

Examples of this need for interaction can be uncovered in other disciplines--Amsden (1968) anthropology; Menzel (1967) engineering; and Mick (1972) education. It has also been emphasized by Dervin (1973) whose schema for the development of an information system links the average citizen and his need for information to his source of information. Bundy (1971) proposed that library schools develop an "information interpreter" to provide an essential link between the client or community and the sources of information. Such a specialist is essential to making the library more relevant to other than middle-class interests and culture.

GUIDELINE IV. Information should be provided in a form suitable to its effective use.

A well-designed system should be tailored to suit the requirements of its users and should not place upon the user an undue burden of mastering a new discipline. The system should "provide its users with the information they need, and as closely as possible in a form suitable to its effective use." (Almendinger, 1966)

Paisley and Parker (1965) would have the system provide information in any form desired by the receiver. If he desires the original text, he should receive that; if he desires an abstract, he should have that. He may even desire an interpretation (i.e., a message of decreased uncertainty and longer length, redundant explanations added). Paisley goes on to say:

If decisions have been made at the system input to provide information in just one form (e.g., abstracts) then the receiver will be satisfied only if he desires the information in that form in the foreseeable future, a computer will respond on-line as desired to the commands, 'Tell me more,' 'Prepare a precis of this' . . . 'Explain terms _____, etc.' The system will then stand in for the source, not stand between them as now.

Menzel (1964) went even further and suggested that information systems should be so designed that the user would be able to receive the desired information in either oral or written form and in an understandable language.

GUIDELINE V. Existing records should be broad enough in scope to provide required information and to allow for accidental discovery.

It is essential to design systems adequate in scope to

provide needed documents as well as peripheral documents so that the user can fulfill through serendipity needs not yet formulated. (Line, 1971)

Systems designers are generally torn between the dilemma of including too much information in the system with the possible danger of overload versus too little information with the built-in danger of serious omission. Documents to support both points of view can undoubtedly be found. However, Paisley (1965), Dunn (1966), Rosenbloom and Wolek (1970) and others stress the importance of comprehensiveness; of more information rather than less.

Rosenbloom and Wolek (1970: revealed that many users were not aware of their need for information until after they received it.

It is clear that information transfer is not just a problem of information retrieval. In the transfer of information of technical information in industrial laboratories, information looking for the man seems to be nearly as frequent an occurrence as the man seeking information.

Paisley (1965) stresses the importance of comprehensiveness. He perceived that if the user believes that the information he is seeking is in the system, he will persevere in the search. If in his search, results are generally negative, he is likely to discontinue the search. For instance, he found that scientists were increasingly skeptical of the comprehensiveness of journal-based information systems. Valuable research reports known to have existed in mimeo-

graphed form never reach publication. Rather than use a system believed to be limited, the researcher tends to seek personal networks to bridge the publication gap. Thus a source, suspected of gaps in coverage, no matter where the fault lies, is not likely to motivate users.

Line (1971) relates the problem of the scope and depth of input to the phenomenon of accidental discovery. "Accidental discovery," he noted, "is a phenomenon with which most researchers are familiar, but which is hard to quantify and harder to evaluate. It is of some importance to attempt to do so, as it affects systems design in a number of ways; most information systems insofar as they are designed at all, tend to aim at precision and the elimination of noise, and it needs to [be] asked whether some facilities for 'accident' should be, if not deliberately built in, at any rate not entirely excluded."

Jiri Nehnevajsa (1966) suggests that: "Each system should be designed so as to permit maximum flexibility in the inclusion of additional information. This is necessary since the specification of initial information bases may be less than perfect and also because information needs at the most specific operational level may change."

Maurice Bishop at Cornell University was overheard to have remarked, "It is not the book I found on the shelf which proved to be most productive, it was the one next to it, which accidentally dropped on my foot."

GUIDELINE VI. The system should be so designed as to provide the right amount of information at the right time.

The librarian is conditioned to thinking in terms of the right book for the right person at the right time. The information scientists thinks not only in terms of "right" but in terms of "amount." Guideline V emphasized comprehensiveness of input; this guideline assumes a sensitivity on the part of the system to disseminate the right amount of information. This is not to suggest that information should be limited, edited, or deleted, but that

there is a distinction between needs and the amount of information necessary to satisfy that need.

An assumption underlying the design of information delivery systems has been that the more information supplied, the greater the production on the part of the researcher. Back (1962) observed that too much information stifled the scientist's curiosity and reduced his productivity. Bernal (1958) pointed out that the absence of information and gaps in knowledge are often the most fruitful impetus to the production of output by the scientist.

Menzel (1964) and Voigt (1959) note that there are different approaches to the amount of information required corresponding to identifiable needs. For instance, there is the need to keep up with information in one's field; there is a need to brush up; there is a need for specific information directly related to a problem at hand; there is a need

for current awareness and finally there is a need for an exhaustive approach to a topic.

The Auerbach Corporation in its study of the Department of Defense (1964) and others tried to measure exactly how much information scientists wanted as based on their stated demands. The two studies indicated that researchers require only one relevant document 30 percent of the time; several documents 20-25 percent of the time; and all information available on a subject 20-24 percent of the time.

Carter (1967) observed a "wide range among users in the quantity of information needed or consumed . . . that it varies both between and within disciplines . . . that variability in amount needed was related to individual motivation, capacity and nature of the task. The system, it is assumed, therefore should be designed to meet the needs of the most motivated as well as the least motivated of the users."

GUIDELINE VII. Information should be stored in such a way that it is not only available but easily accessible.

It has been noted that the search for information was not necessarily undertaken with the idea of maximum return, but with the least energy and effort possible (Carter, 1962). The system, in other words, should be as simple to use and as accessible as possible. Wood (1971) and

Gerstberger and Allen (1968) surveying sources used to select information found that both ease of use and accessibility were more important criteria than potential value when the selection of an information source was made.

Dervin (1973) investigating the information needs of the urban resident identified five different dimensions of accessibility:

1. Societal accessibility. The information and the resources necessary to satisfy the individual's need must be available in the social system.
2. Insitutional accessibility. The information sources must be both capable and willing to deliver the needed information to the individual.
3. Physical accessibility. The individual must be able to make contact with the information sources who have the information he needs.
4. Psychological accessibility. The individual must be psychologically willing to see his needs as information needs, to approach and obtain information from appropriate sources, and to accept the possibility that his problems can be solved.
5. Intellectual accessibility. The individual must have the training and ability that will allow him to acquire and process the information he needs.

Studies of the average citizen, particularly in the larger cities such as Cleveland, Detroit, Atlanta, Queens, Houston, have demonstrated that the citizen is frustrated in his attempt to get information. Voos (1969), Zweizig (1972) and Turick (1973) point to the library as a major information source, but one with built-in constraints to accessibility.

"The different perceptual basis of needs citizens have may well act as barriers to information accessibility." The results of the Baltimore study (1973) and the Seattle study (1973) point out that generally neither the general public nor the library staff can separate information needs from problems. Thus, unless the library staff can infer a need from the problem, it limits its accessibility to the public as both a counselling and service agency. Pilot studies in these five cities have shown that the successful libraries are those with staff trained to ease the path to accessibility of information for the general public, particularly the ethnic and minority groups, the aged and the unemployed. To be a successful advocate of information, the patron who comes in with an obvious need for food stamps, will not be given a publication on the high cost of food, but will be directed to a food stamp distributor.

There are innumerable studies on the need for accessibility to information. One of the more dramatic of these studies relates to the decline of power of modern legislatures. Janda (1968) pointed to the Woll, Keefe and Ogul report identifying Congress' deferment to the Executive for answers and recommendations and noted that "regardless of how much Congress has attempted to inform itself . . . its store of information and its access to necessary knowledge are rarely if ever as developed as that of the Executive authority."

GUIDELINE VIII. Standards must be developed to insure the utility of future data collections.

Today's information, in whatever form it may appear, is tomorrow's archive. To improve that data and to make certain that it will be available and accessible, certain standards and guidelines must be developed to insure its durability.

Robert Barnes, Chief, Training and Research Branch, Dualabs, discussing 1970 census information tapes, stated that it is now evident that the data on these tapes will have to be transferred to other tape or microfilm to preserve these data for future use. The magnetic oxides on these tapes are sensitive to use and have been shifting and changing.

Bisco (1970) pointed out that it was essential to improve the data that will eventually constitute the majority of archival holdings. It is necessary to begin now, in cooperation with data collection institutions that supply archival materials, to establish standards and guidelines that will encourage richer and more empirical coding and will ensure capturing information about demographic and other basic variables. There must be guidelines for documentation, cleaning and standards for improving the utility of future data collection for widespread use by present researchers as well as historians in the future.

Currently it has been noted, to the chagrin of the social scientists and the scientists examining data, that

much of it is produced by different agencies with different standards in different formats and often for a special purpose not related to their own research requirement.

Dunn (1966) observed that existing numerical records are often not only difficult to access in appropriate and useful forms, but that institutional procedures and mission concepts make these constraints more damaging than necessary.

GUIDELINE IX. The system should assume that the user has not articulated his information need.

Brenda White (1970) observed that "determining the precise nature of user's information requirements in any subject field is a difficult exercise, simply because the requirements are rarely articulated by the users themselves, and this in turn because they are rarely aware of them." Thus designers cannot be certain that they know the information needs of the system users. In the case of planners, for instance, Miss White speculated that a survey of 3,000 planners would be required to achieve a valid indication of their information requirements.

The problem with defining information needs is that these needs do not exist as universal and objective entities; they are formed by individual characteristics and environmental circumstances. Because a great many people have difficulty conceptualizing their information needs, much less articulating them, such needs are frequently inferred.

If, as it has been noted, the professional, the researcher and the subject specialist have difficulty in expressing their information needs, how much more pronounced is the difficulty for the average citizen. Dervin (1973), Olsen (1972) and others noted that the definition of "information" for the average citizen was "something which one needed when faced with a problem requiring some decision." Information needs were inferred from the respondent's statement of a problem. In fact, this entire paper has been developed on the premise that one of the most difficult problems faced by the information specialist is the need to determine the true nature of needs, wants and demands.

GUIDELINE X. The system should adapt itself to the receiver's associative habits and not insist on the converse.

The above, postulated by Paisely, suggests that the system should be compatible with the user or receiver's (Paisley's term) search strategy. Paisley (1965, 1970), Menzel (1959, 1964) and Doyle (1962) point out that the user knows how he usually goes about looking for information and if the system is like-minded, then the user's "search is expedited and his satisfaction in using the system is greater." Doyle (1962) and Deese (1962) have both worked on the problems the user incurs in working with systems incompatible with his own behavioral strategies in seeking information and suggest some strategies by which the system

can master the receiver's associations, define these in relation to strategies already in the system and then complement the user's intuitive search strategy.

Frequently, the searcher, unable to locate information according to his own information seeking behavior, may leave the system with the conviction that it does not contain the information needed (Paisley and Parker, 1966).

GUIDELINE XI. Since oral communication is an important feature of gathering information, the system should devise ways for facilitating the dissemination of such information.

Information channels of communication referred to as invisible colleges are frequently the most significant means of obtaining information. Menzel (1964) remarked that person-to-person and other informal, often unplanned, communications play a surprisingly great role in the communication experiences of scientists. "In spite of the prodigious planned efforts at communication by individual scientists and professional organizations, publishers and institutions, a good deal of useful information is obtained by scientists through correspondence, visits, corridor conversations and during activities undertaken and occasions sought out for different purposes." (Menzel, 1964)

Innumerable studies of the invisible college by Price (1963), Line (1971), Parker (1966), Crum (1961), Carter (1967) and Wood (1970, 1971) indicate that this

guideline be seriously considered by the designer of information systems.

Having presented the foregoing guidelines, based on specified user information requirements, there are circumstances when we must consider alternative ways of providing information to meet user needs. Here is one such alternative:

GUIDELINE XII. Availability of information can be more important than specific information requirements.

This premise can perhaps best be illustrated by the problems confronting the urban and municipal planner. Hearle (1963) discussing information systems for urban planning and city management noted that it was not that information was not available but that it was scattered and duplicated. He found that data systems created for specific functions, such as student files, police files and employment files not only duplicate each other, but are also difficult to locate since each is stored in a different department. The information collected for one agency is generally unknown to users of another and is usually not shared because of jurisdictional, mechanical or procedural obstacles. This suggests, therefore, a positive need for planners to know what information is available and where.

Hearle stressed the need for a unified information

information system to reduce duplication in collection, storage and processing. He suggested that information systems should be developed on the theory of availability of information rather than on information requirements. By having all information available without concern for the user's needs at the moment or for what the user will do with the information, more information will be utilized and more needs will be satisfied.

Cityphone, a free data service in New York City, provides information on where to find and where to go for nearly everything in New York City. Eugene Gottesman, its founder, believes that "people long to be connected." He wanted to prove to merchants that citizens do need information. The information needed may not result in scientific breakthroughs, but it does satisfy what the average citizen may be seeking. Cityphone hotlines have been installed in the Tourist Information Center in Times Square by the city's Economic Development Administration. TransWorld Airlines has installed Cityphone hotlines in the baggage areas of Kennedy and LaGuardia airlines. (New York Times, February 24, 1974)

These are but a few guidelines gleaned from the study of information needs . . . and they are just that: a fraction of the thought which must go into the development of an information system. The literature on information

needs and users will continue to grow and will result in stronger guidelines for the design of information systems. However, one cannot end this chapter without reference to two observations, one expressed by Herner (1962), and Carter et al (1967), and the other by Parker (1973). Herner and others remind one that no system, however sophisticated, can meet all the information needs of any user group; Parker emphasizes the societal relationship between information and the individual.

A study of information needs of society would be incomplete if it focused entirely on the information needs of individuals in society. Information is a public good with external benefits such that each of us may benefit when our fellows are better informed. Therefore, when viewed from the perspective of society as a whole, the social need for information may be greater than the aggregate of individual needs or demands. (*Italics ours*).

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